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MODIS Lab Report

Problem Statement:

Human activities such as developing land and the burning of fossil fuels constantly have an impact on the environment. Land use changes the surface of the planet and limits biodiversity in the developed area. The burning of fossil fuels releases harmful greenhouse gasses that increase rates of global warming affecting all life on the planet especially photosynthesizing plants. At the study site there have been drastic changes in land use in the last several years. A large area of woods has been converted into a soccer complex. The goal of this activity is to analyze data collected at the study site and determine if there are any drastic changes in the plant life in the area due to the new land development in the area. This activity also plans to explore how temperature affects the growth of vegetation in the region in order to determine if man made global warming may greatly affect the phenology of plants in the upcoming years as rates of fossil fuel consumption increases.

Hypothesis:

If the land surface temperature, surface reflectance, and leaf area index area analyzed for the study area over a period of ten years, then there will be observable correlations between increases in land development and temperature, and the phenology and abundance of vegetation. With an increase in human development a decrease in vegetation is expected, and with increases with surface temperature an extended growing season is anticipated.

Materials:

* MODIS database
* Google Earth

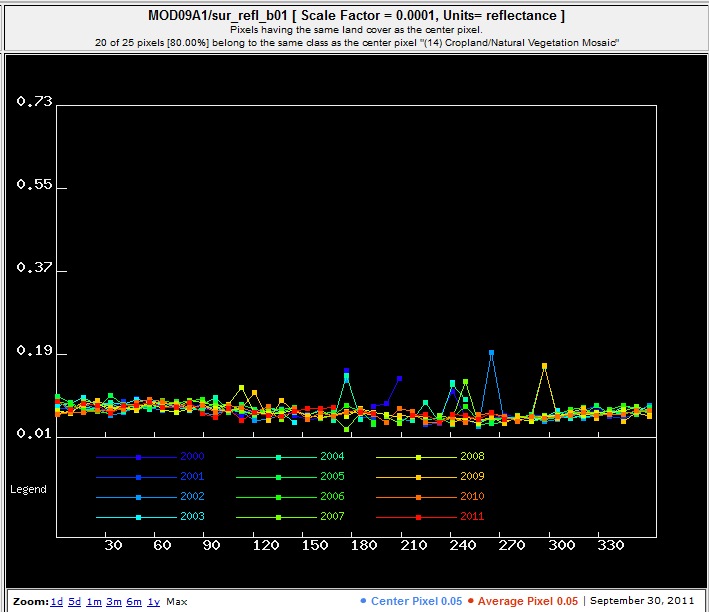
Procedure:

First a study site was located and visited. General observations were made about the areas located within the study region. These observations were then used to generate predictions and a hypothesis pertaining to land development and the temperatures influence on plant phenology and growing season. Next data subsets were ordered from the MODIS database with the required information to make conclusions about plant growth influences in the area. Finally the data was analyzed and conclusions were drawn.

1. Study site location: Latitude 34.746453°, Longitude -77.475569°
2. Make general observations at the study site.
3. Make predictions and generate a hypothesis.
4. Collect data from the MODIS database including land surface temperature, surface reflectance, and leaf area index.
5. Analyze the data and identify any correlations between land use and temperature change, and plant phenology and abundance.

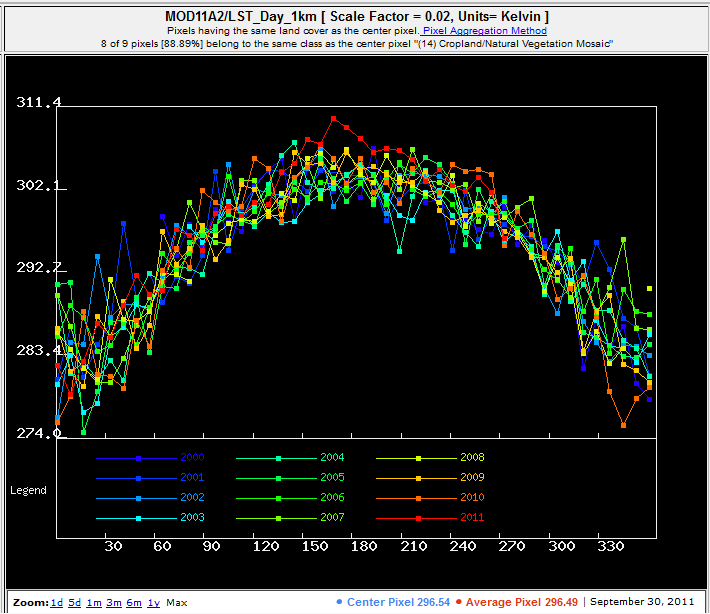
Data:

Surface area Reflectance



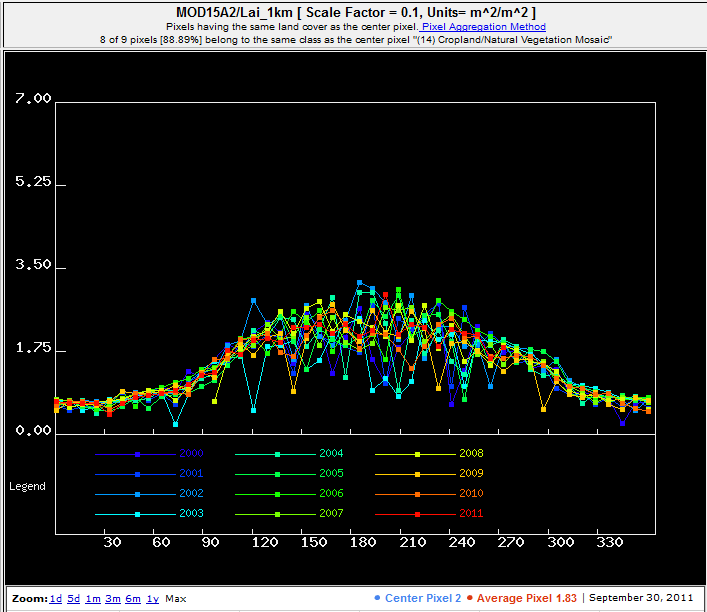
The clearing of land in the study area to create soccer fields occurred between the years of 2002 and 2003. The above graph clearly illustrates peaks in the surface reflection during this time period. This occurs because the albedo of bare soil (0.17) is greater than the albedo of forested areas (0.09-0.15). There are also additional peaks in the graph between 2008 and 2009 which coincide with the planting of grass in the area which has an even higher albedo than bare soil (0.25). The conversion of a forested area into recreational fields changed the surface reflectance of the entire study region. This helps to illustrate how man made changes to surface coverage can have an environmental impact.

Land Surface Temperature



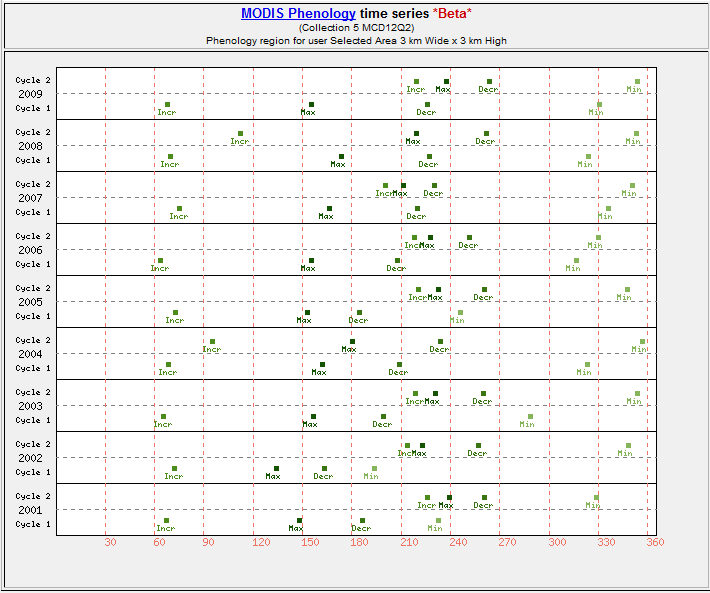
The above graph represents the land surface temperatures of the study site. There are peaks in the graph during the years of 2001 and 2002. This suggests that some natural variation in temperature may have been occurring, but these sudden increases of temperature also coincide with the clear cutting of land to create soccer fields. There may be some correlation between the change in surface covering and the peaks in temperature. 2010 and 2011 also appear to be warmer than average years. This may be a result of the increase global warming in recent years.

Leaf Area Index



The above graph shows drastic drops in leaf are coverage in the years ranging between 2001 and 2003. This coincides with the clear cutting of a large wooded area within the study area. The other remaining years seem to have a fairly consistent level of leaf coverage between consecutive years.

Plant Phenology



The above graph does not seem to present any major changes taking place in the phenology of plant growth that cannot be accounted for with natural variation between years. The lack of significant change in plant phenology suggests that global climate change has not yet begun to have any significant changes in plant growth at the study site in the past decade.

Conclusion:

The hypothesis did not prove to be completely correct. There were changes in environmental conditions such as surface reflectance and temperature due to human development, but these changes did not appear to have any significant impact on plant phenology. During years of clear cutting surface reflectance and temperature peaked and the leaf area index decreased rapidly. However these environmental influences did not appear to have affected phenology of the remaining plants in the study area. Their growing season seems to continue to follow the patterns of previous years despite the influence of human development and global warming. Understanding how continued global warming and human development affect the growth of vegetation will help scientist predict environmental issues in the future before they occur. These are topics that must continue to be studied in greater detail in order to fully understand how plant phenology may be influenced in the future.